

### Amendments to the Claims

This listing of claims will replace all prior versions and listings of claims in the application.

1. (currently amended) A method for separating a ~~nucleic acid~~ polynucleotide of interest from a population of nucleic acid molecules, the method comprising;

(a) providing a population of nucleic acid molecules comprising at least one ~~nucleic acid sequence~~ polynucleotide of interest, wherein said ~~at least one nucleic acid sequence~~ polynucleotide of interest includes a first target nucleic acid sequence in the vicinity of a first distinguishing element;

(b) contacting said population of nucleic acid molecules with a first targeting element, wherein said first targeting element binds specifically to said first target nucleic acid sequence;

(c) selectively attaching a first separation group to said bound first targeting element, wherein attachment of said first separation group ~~is conditional on the presence of~~ occurs only if said first targeting element is bound to said first target nucleic acid sequence and said first distinguishing element is present in the vicinity of said bound first targeting element;

(d) immobilizing said bound first targeting element via said attached first separation group to a substrate, thereby forming an immobilized first targeting element-separation

group complex comprising ~~said at least one nucleic acid sequence of interest~~ the polynucleotide of interest of step (a); and

(e) removing said immobilized first targeting element-separation group complex comprising ~~said at least one nucleic acid sequence~~ the polynucleotide of interest of step (a) from said population of nucleic acid molecules, thereby separating said ~~nucleic acid sequence of interest~~ polynucleotide of interest of step (a) from said population of nucleic acid molecules.

2. (cancelled)

3. (currently amended) The method of claim 1, wherein said first targeting element binds to said ~~at least one nucleic acid sequence~~ polynucleotide of interest at a first target nucleic acid sequence within 20 nucleotides of said first distinguishing element.

4. (currently amended) The method of claim 1, wherein said first targeting element comprises a nucleic acid sequence.

5. (currently amended) The method of claim 4, wherein said first targeting element is an oligonucleotide.

6. (original) The method of claim 5, wherein said oligonucleotide has an extendable 3' hydroxy terminus.

7. (currently amended) The method of claim 6, wherein said first separation group is an immobilizable nucleotide.

8. (original) The method of claim 7, wherein said immobilizable nucleotide is a biotinylated nucleotide.

9. (currently amended) The method of claim 8, wherein said first separation group is attached to said first targeting element by extending said oligonucleotide with a polymerase in the presence of said biotinylated nucleotide, thereby forming an extended oligonucleotide primer containing said immobilizable nucleotide.

10. (currently amended) The method of claim 3, wherein said first targeting element is an oligonucleotide.

11. (currently amended ) The method of claim 10, wherein said first separation group is an immobilizable nucleotide.

12. (original) The method of claim 11, wherein said immobilizable nucleotide is a biotinylated nucleotide.

13. (original) The method of claim 1, wherein said population of nucleic acids is a population of DNA molecules.

14. (previously amended) The method of claim 13, wherein said population of DNA molecules is a population of cDNA molecules.

15. (original) The method of claim 1, wherein said population of nucleic acid molecules is a population of RNA molecules.

16. (amended) The method of claim 1, wherein said first distinguishing element is a single nucleotide polymorphism.

17. (original) The method of claim 1, wherein said substrate is a particle, bead, magnetic bead, or glass surface.

18. (currently amended) The method of claim 1, further comprising contacting said population of nucleic acid molecules with a second targeting element simultaneously with said first targeting element, wherein said second targeting element binds specifically to a second ~~at least one nucleic acid sequence of interest~~ target nucleic acid sequence in a second polynucleotide of interest in the vicinity of a second distinguishing element in said population of nucleic acid molecules;

attaching a second separation group to said second bound targeting element;

immobilizing said attached second targeting element via said attached second separation group to a substrate, thereby forming a second immobilized targeting element-separation group complex comprising said second ~~at least one nucleic acid sequence of~~ polynucleotide of interest; and

removing said immobilized second targeting element-separation group complex comprising said second ~~at least one nucleic acid sequence of interest~~ polynucleotide of interest from said population of nucleic acid molecules, thereby separating said second ~~at least one nucleic acid sequence of interest~~ polynucleotide of interest from said population of nucleic acid molecules.

19. (currently amended) A method for separating a polynucleotide ~~nucleic acid~~ ~~sequence~~ of interest from a population of nucleic acid molecules, the method comprising;

(a) providing a population of nucleic acid molecules comprising ~~at least one nucleic acid~~ ~~sequence~~ a polynucleotide of interest, wherein said ~~at least one nucleic acid sequence of~~ ~~interest~~ polynucleotide of interest includes a target nucleic acid sequence in the vicinity of a distinguishing element;

(b) contacting said population of nucleic acid molecules with a targeting element attached to a separation group, wherein said targeting element binds specifically to said target nucleic acid sequence;

(c) selectively removing said attached separation group from said bound targeting element, wherein removal of said separation group ~~is conditional on the absence of~~ occurs only if said distinguishing element ~~in~~ is absent from the vicinity of said bound first targeting element;

(d) immobilizing to a substrate separation groups remaining attached to said targeting element, thereby forming an immobilized first targeting element-separation group complex comprising said ~~at least one nucleic acid sequence~~ polynucleotide of interest from step (a); and

(e) removing said immobilized targeting element-separation group complex comprising said ~~at least one nucleic acid sequence~~ polynucleotide of interest from step (a) from said

population of nucleic acid molecules, thereby separating said ~~nucleic acid sequence of interest~~ polynucleotide of interest from step (a) from said population of nucleic acid molecules.

20. (cancelled)

21. (previously added) The method of claim 13, wherein said population of DNA molecules is a population of genomic DNA molecules.

22. (new) A method for separating a polynucleotide of interest from a population of nucleic acid molecules, the method comprising;

(a) providing a population of nucleic acid molecules comprising at least one polynucleotide of interest, wherein said polynucleotide of interest includes a target nucleic acid sequence in the vicinity of a distinguishing element;

(b) contacting said population of nucleic acid molecules with an oligonucleotide that binds specifically to said target nucleic acid sequence;

(c) selectively attaching a separation group to said bound oligonucleotide, wherein said separation group comprises an immobilizable nucleotide, and wherein attachment of said separation group occurs only if said oligonucleotide is bound to said target nucleic acid sequence and said distinguishing element is present in the vicinity of said bound oligonucleotide;

(d) immobilizing said bound oligonucleotide via said attached separation group to a substrate, thereby forming an immobilized oligonucleotide -separation group complex; and

(e) removing said immobilized oligonucleotide -separation group complex from said population of nucleic acid molecules, thereby separating said polynucleotide of interest of step a) from said population of nucleic acid molecules.

23. (new) The method of claim 22, wherein said oligonucleotide has an extendable 3' hydroxy terminus.

24. (new) The method of claim 22, wherein attachment of said separation group to said oligonucleotide is covalent.

25. (new) The method of claim 22, wherein said separation group is attached to said oligonucleotide by extending said oligonucleotide with a polymerase in the presence of said biotinylated nucleotide, thereby forming an extended oligonucleotide primer containing said immobilizable nucleotide.

26. (new) A method for separating a nucleic acid sequence of interest from a population of nucleic acid molecules, the method comprising;

providing a population of nucleic acid molecules comprising at least one nucleic acid sequence of interest, wherein said at least one nucleic acid sequence of interest includes a target nucleic acid sequence in the vicinity of a distinguishing element;

contacting said population of nucleic acid molecules with a targeting element, wherein said targeting element binds specifically to said target nucleic acid sequence;

selectively and covalently attaching a separation group to said bound targeting element, wherein attachment of said separation group occurs only in the presence of said distinguishing element in the vicinity of said bound targeting element;

immobilizing said bound targeting element via said attached separation group to a substrate, thereby forming an immobilized targeting element-separation group complex comprising said at least one nucleic acid sequence of interest; and

removing said immobilized targeting element-separation group complex comprising said at least one nucleic acid sequence of interest from said population of nucleic acid molecules, thereby separating said nucleic acid sequence of interest from said population of nucleic acid molecules.

27. (new) The method of claim 26, wherein said at least one nucleic acid sequence of interest is an amplified nucleic acid sequence.

28. (new) The method of claim 26, wherein the covalent attachment of a separation group occurs through ligation.

29. (new) The method of claim 26, wherein the covalent attachment of a separation group occurs by extending an oligonucleotide with a polymerase.

30. (new) A method for separating a polynucleotide of interest from a population of nucleic acid molecules, the method comprising;

(a) providing a population of nucleic acid molecules comprising at least one fragment of



genomic DNA, wherein said fragment of genomic DNA includes a target nucleic acid sequence in the vicinity of a distinguishing element;

(b) contacting said population of nucleic acid molecules with an oligonucleotide probe that binds specifically to said target nucleic acid sequence;

(c) selectively and covalently attaching a separation group to said bound oligonucleotide probe, wherein said separation group is an immobilizable nucleotide and attachment occurs only if said oligonucleotide probe is bound to said target nucleic acid sequence and said distinguishing element is present in the vicinity of said bound oligonucleotide probe;

(d) immobilizing said bound oligonucleotide probe via said attached separation group to a substrate, thereby forming an immobilized oligonucleotide probe -separation group complex comprising the fragment of genomic DNA of step (a); and

(e) removing said immobilized oligonucleotide probe -separation group complex comprising the fragment of genomic DNA of step (a) from said population of nucleic acid molecules, thereby separating said fragment of genomic DNA from said population of nucleic acid molecules.

31. (new) The method of claim 30, where the distinguishing element is a polymorphism.

32. (new) The method of claim 38, wherein the polymorphism is a single nucleotide polymorphism.

33. (new) A method for separating a polynucleotide of interest from a population of nucleic acid molecules, the method comprising;

(a) providing a population of nucleic acid molecules comprising at least one polynucleotide of interest, wherein said polynucleotide of interest includes a target nucleic acid sequence in the vicinity of a distinguishing element;

(b) contacting said population of nucleic acid molecules with a targeting element containing an attached separation group, wherein said targeting element-separation group binds specifically to said target nucleic acid sequence in said polynucleotide of interest;

(c) selectively stabilizing the binding of said targeting element-separation group to said target nucleic acid sequence, wherein stabilization of said targeting element-separation group occurs only if said targeting element-separation group is bound to said target nucleic acid sequence, and said distinguishing element is present in the vicinity of said bound targeting element;

(d) immobilizing said stabilized targeting element via said attached separation group to a substrate, thereby forming an immobilized targeting element-separation group complex comprising the polynucleotide of interest of step (a); and

(e) removing said immobilized targeting element-separation group complex comprising the polynucleotide of interest of step (a) from said population of nucleic acid molecules, thereby separating said polynucleotide of interest from said population of nucleic acid molecules.

34. (new) The method of claim 33, where the targeting element is an oligonucleotide.

35. (new) The method of claim 33, where the targeting element binds within 20 nucleotides of said distinguishing element.

36. (new) The method of claim 33, where the distinguishing element is a sequence polymorphism.

37. (new) The method of claim 33, wherein the polymorphism is a single nucleotide polymorphism.

38. (new) The method of claim 33, where the targeting element-separation group is an oligonucleotide comprising a biotinylated nucleotide.